

Estimating Times of Remediation Associated with Monitored Natural Attenuation and Contaminant Source Removal # 157

**May 6-7, 2002
Scottsdale, Arizona**

Presented by: Frank Chapelle, Mark Widdowson, Eduardo Mendez

Course Description

Under suitable conditions, monitored natural attenuation (MNA) can be an effective strategy for restoring aquifer systems contaminated with chlorinated ethenes or petroleum hydrocarbons, particularly in combination with source zone treatment technologies designed to remove or destroy non-aqueous phase liquids (NAPL). Partial NAPL removal/destruction can be acceptable to regulators so long as 1) time of remediation is reduced to an acceptable timeframe and 2) it can be shown that the post-treatment contaminant plume will restabilize at concentrations compatible with site-specific compliance targets. The question then becomes, “What level of source zone treatment is adequate to meet site-specific remediation goals and what is the time required for natural attenuation processes to lower contaminant concentrations to levels protective of human health and the environment?”

This course will present a decision-making framework and methodology for assessing MNA and estimating timeframes required for natural attenuation processes to lower contaminant concentrations and mass to predetermined regulatory goals. An interactive computer program (Natural Attenuation Software, NAS) has been developed by the authors of this course to assess MNA at chlorinated ethenes or petroleum hydrocarbons sites. The software is designed to provide quantitative estimates for source zone treatment and the time of remediation using site-specific data and remediation goals.

The course will guide participants in using NAS and provide an understanding of the decision-making framework and methodology incorporated into NAS. Course participants will work through exercises and tutorials on assessing and implementing MNA at DNAPL and LNAPL sites, using real-world data.

Course Objectives

Upon completion of this course, the attendee will be able to:

- Appropriately use NAS to implement MNA and source zone remediation at sites.
- Effectively analyze MNA protocol data to determine redox zonation.
- Calculate natural attenuation capacity and contaminant degradation rates for single and multiple redox zone aquifers.
- Determine the optimal level of source zone remediation to meet site-specific remediation objectives combined with a MNA-based remediation strategy.
- Estimate the time of remediation under MNA with and without source zone remediation for LNAPL and DNAPL sites.

Course Agenda

Day One

Introduction – Defining the Problem

- ◆ History of MNA
- ◆ EPA OSWER Directive - What constitutes “Time of Remediation”?
- ◆ MNA as a remediation strategy
- ◆ Combining MNA with Contaminant Source-Removal Actions
- ◆ Defining the Problem

Natural Attenuation Software – Overview and Evaluating Site Data

- ◆ Objective of NAS and types of problems
- ◆ Evaluating site data
- ◆ Estimating Distance of Stabilization (DOS) and Time of Stabilization (TOS) for dissolved plumes.
- ◆ Exercise 1 – Introduction to NAS Software

Natural Attenuation Capacity

- ◆ Hydrologic and microbial processes
- ◆ Methods for quantifying biodegradation rates
- ◆ Exercise 2 – Calculating NAC in a Single zone

Natural Attenuation of Petroleum Hydrocarbon Compounds

- ◆ MNA for BTEX and MTBE sites
- ◆ Biodegradation under variable redox conditions
- ◆ Required data for evaluating TEAP zonation using NAS
- ◆ Calculating NAC in a multiple zone aquifer
- ◆ Exercise 3 – Hydrogeology, contaminant, and Redox data entry
- ◆ Distance of Stabilization Estimates
- ◆ Time of Stabilization Estimates
- ◆ Use of DOS and TOS Estimates in site remediation for petroleum hydrocarbons

Natural Attenuation of Chlorinated Ethenes

- ◆ MNA for PCE and TCE sites
- ◆ Biodegradation mechanisms: Reductive dechlorination, oxidation, cometabolism.
- ◆ Influence of redox on attenuation
- ◆ Data entry for chlorinated ethenes
- ◆ Exercise 4 – Hydrogeology, contaminant, and Redox data entry
- ◆ Distance of Stabilization Estimates
- ◆ Time of Stabilization Estimates
- ◆ Use of DOS and TOS Estimates in site remediation for chlorinated ethenes

Day Two

Time of Remediation for NAPLs in Ground-Water Systems

- ◆ Physics of NAPL dissolution.
- ◆ Estimating NAPL Mass
- ◆ Importance of NAPL Geometry

SEAM3D – Sequential Electron Acceptor Model, 3D Transport

- ◆ Fundamental Concepts and Packages
 - MT3DMS – parent code
 - NAPL Dissolution Package
 - Biodegradation Package
 - Reductive Dechlorination Package
- ◆ Application to MNA

NAPL Dissolution Time Estimates for Petroleum Hydrocarbon

- ◆ Laurel Bay site
- ◆ Exercise 5 – Using NAS to evaluate NAPL dissolution and TOR
 - *NAPL mass*
 - *NAPL geometry*
 - *Ground water velocity*
 - *NAPL removal strategies*
- ◆ Post-auditing TOR estimates

NAPL Dissolution Time Estimates for Chlorinated Ethenes

- ◆ Kings Bay site
- ◆ Exercise 6 – Using NAS to evaluate NAPL dissolution and TOR
- ◆ Post-auditing TOR estimates

Course Wrap-up/Questions/Comments

Course Instructors

Frank Chapelle is a Research Hydrologist with the U.S. Geological Survey in Columbia, South Carolina. His research has focused on how microbial processes affect the chemistry of ground water in pristine and contaminated ground-water systems. He is the author of the textbook *Ground-Water Microbiology and Geochemistry* (John Wiley & Sons 2000) and was the 2000 recipient of the Meinzer Award in Hydrogeology given by the Geological Society of America. He is a graduate of the University of Maryland, and received his Ph.D. from the George Washington University.

Mark Widdowson is an Associate Professor with the Charles E. Via, Jr. Department of Civil and Environmental Engineering at Virginia Tech in Blacksburg, Virginia. He is an expert in

reactive contaminant transport modeling and has over 16 years of experience creating, developing, and applying computer models for subsurface remediation of petroleum hydrocarbons and chlorinated solvents. He is the co-author and principal investigator of the solute transport code *SEAM3D* (Sequential Electron Acceptor Model for 3D Transport) for simulating biodegradation and transport of contaminants with NAPL dissolution in aquifers and *NAS* (Natural Attenuation Software). His teaching and research interests include bioremediation and phytoremediation, modeling groundwater flow and transport, hydrology and hydraulics. He teaches short courses on natural attenuation to state and federal government agencies. He received his Ph.D. in Civil Engineering from Auburn University, M.S. in water resource engineering from the University of Kansas, and B.S.C.E. from the University of Cincinnati.

Course Materials

Each attendee will receive:

- Course Notes
- Natural Attenuation Software (NAS) – public domain software
- User's Guide

Attendees Need to Provide

- Laptop Computer
- Calculator

Who Should Attend

- Regulators will receive a framework for estimating time of remediation (TOR) at sites with NAPL sources and for estimating time of stabilization (TOS) following source zone remedial action based on site-specific remediation goals.
- Site Managers who have corrective action responsibilities will learn how to determine the adequate level of source zone remediation to meet site-specific remediation goals and make remediation decisions.
- Engineers, hydrogeologists, and scientists will receive training on techniques for assessing redox-specific natural attenuation capacity, determining the level of source zone remediation, and estimating TOS and TOR.

Education Level

Intermediate. A background level of basic knowledge in contaminant transport and natural attenuation is recommended.

CEUs (NGWAS offers CEUs)

1.6 continuing education units

Fees (Prices valid for the May 2002 offering only)

NGWA member - \$825

Prospective member - \$975

Location

Chaparral Suites Resort
5001 N. Scottsdale Road
Scottsdale, Arizona 85250
Phone: (480) 949-1414
Fax: (480) 947-2534
www.chaparralsuites.com

Rate: \$119.00 single
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Membership Features

- ◆ Members of National Ground Water Association enjoy the following:
- ◆ Advanced notices of opportunities to participate in professional conventions and conferences
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Registration and General Information

Registration Pre-registration is necessary for participation in limited-enrollment short courses and to receive course materials. Payment must be received by NGWA three weeks prior to the course to ensure pre-registration and check processing. The registration fee covers notebook, materials, instruction, and beverage breaks. If you are unable to pre-register, please call the NGWA Registration Department to confirm that space is available in the course.

When registering, please indicate requirements for handicapped facilities, equipment, materials, or diet. Please advise us of special requirements 30 days prior to the beginning of the course.

Team Discounts Team discounts are available. Contact our Customer Service department for more information

Course Cancellation Policy/Substitutions A 100% refund is granted for course cancellations if NGWA is notified at least three weeks before the course. Cancellations made less than three weeks prior to the course will receive a \$150 cancellation charge. All fees will be forfeited if cancellations are received less than 7 days prior to the course. One substitute is permitted per registrant for the entire course; daily substitutions are not permitted. NGWA must be notified prior to the first day of the course when a substitution will occur.

CEUs (Continuing Education Units) NGWA offers CEUs.

Hotel Blocks NGWA does not arrange for hotel accommodations. Rooms are blocked at the host hotel at the rates posted in the course brochure. NGWA secures blocks of rooms for the convenience of attendees months in advance. Because most hotels use a yield management policy, room rates may change daily and NGWA cannot guarantee rates stated in this brochure to be the lowest available. Government employees should contact the hotel directly to inquire about special rates. Check with your travel agent to determine the best hotel and airline for your needs. NGWA neither endorses nor recommends a specific hotel property or airline.

Airline Information Please do not purchase non-refundable airline tickets more than 21 days prior to the course. Should a course require cancellation NGWA is not responsible for nonrefundable airline tickets.

Logistical Information On-site registration occurs from 7:30 to 8:00 a.m. on the first day of the course. Daily instruction lasts until 5:00 p.m.

Tax Deduction for Education Expenses An income tax deduction is permitted for education expenses (registration fee, cost of travel, lodging, and books) undertaken to either maintain/improve skills required in one's employment/business, or meet expressed requirements of an employer imposed as a condition to retain employment, rate status, or rate of compensation. Meals and beverages may be deductible up to 50%.

Guarantee If you are not completely satisfied with the content of this course, NGWA will refund the entire registration fee within 30 days of the program. Please submit in writing the reason(s) you were dissatisfied within 30 days of the course.

Note: NGWA reserves the right to amend courses, change speakers, or revise topic outlines as necessary to ensure a quality program.

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24 hours a day, 7 days a week.
(allow two weeks for
confirmation.)

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registration form to
National Ground Water Assn.
Attn: Registration #497
Dept. 481
Columbus, Ohio 43265-0481
(allow 4-6 weeks for
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Phone, use the web or fax your registration after April 5, 2002

1. Yes! Enroll me in: Estimating Times of Remediation Associated with Monitored Natural Attenuation and Contaminant Source Removal #157 Scottsdale, Arizona May 6-7, 2002

Fee: ____ NGWA Member: \$825 ____ Prospective Member: \$975

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NGWA INFORMATION

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ORGANIZATION INFORMATION

4. Company/Organization Name _____
Business Address _____
City, State, Zip _____
Phone (business) _____ Fax _____

Check here if the above is a change of address

METHOD OF PAYMENT

A form of payment must accompany this registration form to be enrolled in this course.

5. My \$_____ registration fee is enclosed. (in U.S. funds)

Charge to: Credit Card # _____

Exp. Date _____

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Make checks payable to NGWA in U.S. funds. Check # _____

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